FIN FISH ASSEMBLAGE OF THE MAIN CHANNEL OF THE LOWER BENUE RIVER, NIGERIA

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ABSTRACT

Fish species assemblage in the lower Benue River was assessed by collecting samples in 5 establiseh sample stations within Benue state. Some physical and chemical parameters were also assessed. The mean values of the parameters recorded include; Temperature. 24^0 C, p^H = 7.09, Alkalinity (Cac_{03}) = (37 mg/1)Amonia (NH_3) = (37.9 mg/1), C_{02} = (9.5mg/1), Chloride (Nacl) = (12.8mg/1), Total hardness = (11mg/1), Dissolved oxygen (Do) = (11mg/1), and Turbidity = (45cm). Forty eight (48) fish species belonging to 32 genera in 18 families were recorded. It was observed that the family Bagridae had the highest number of species (7, 15%) mormyridae, characidae and mochokidae followed with 5 species (10.63%) each. Cyprinidae, clariidae and cichlidae had 8.51% with 4 species each. Citharinidae formed 6.38% with 3 species, while schilbeidae formed 4.25% (2 species). All other families had only one species recorded in it (2. 12%). Bagridae and clariidae dominated in station 1, while the family mochokidae showed dominance in station 5. Family Ariidae, gymnarchidae and centropomidae were rare in the lower Benue River. There were no significant differences in the abundance of the fish species caught in the different stations. Among the stations also, the number of fish caught during the seasons did not differ ($p<0.05$). These physical and chemical factors did not significantly affect occurrence and even distribution of fish in the study.

INTRODUCTION

Fish stock assessment evaluates the effects of fishing on a fishery as a basis for fishery management decisions (Alfred-Ockiya, 1983). The fundamental models used are based on four forces: growth, recruitment, natural and fishing mortality. Recruitment is a major source of variability in fish population (Bankole, 1990). Fish abundance, and gear selectivity are yardsticks for assessing population dynamics. Fish assemblage, catch composition and seasonality are measurements of fish recruitment in a fishery. According to Bankole (1990), these provide information on the species checklist and the sustainability of the fishery to assist fisheries managers and administrators for positive management decisions.

Reid and Sydenham (1979) defined the lower Benue as the Benue River Basin down stream of the Faro Benue confluence, an area, which is contained within the Federal Republic of Nigeria. The lower Benue River has hitherto received little attention from systematic ichthyologists. The publications on the lower Benue ichthyo-fauna are rather scanty. Ita (1993) surveyed the inland fishery resources of Nigeria and discussed fishing activities along the River Benue with respect to fish production, he highlighted that the hydrology of Nigeria is dominated by two great River systems, the Niger-Benue and the Chad systems. With the exception of a few rivers that empty directly into the Atlantic Ocean, all other flowing waters ultimately find their way into the Chad Basin or down the lower Niger to the sea. The two river systems are separated by a primary watershed, which extends northeast and northwest from the Bauchi plateau, and is the main source for their principal tributaries. Northwest of the plateau lies the elevated, drift covered plains of central Hausa land, which is drained by numerous streams. Researchers like Ita (1993), Reid and Sydenham (1979), Reed *et al* (1967) have done much work on the fisheries of northern Nigeria. According to Reid and Sydenham (1979), the possibility that during the Pleistocene, the Benue River acted as a link way between the Niger and the Chad basins, and that this may have facilitated the dispersal of the Nilo-Sudan ichthyofauna at that time. It can be shown, however that, connections between the Benue River and the Lake Chad basin exist at the

present time. According to Marie *et al* (2001), the river consists of a series of braided channels of different size, which meander across the flood plain. The flood plain also contains seasonally inundated depressions known as Fadamas. On the lower Benue river, during the flood season swampy connections with the Chad Basin are formed at points on the Bagel and Hawai tributaries. Of the long term results implicit in this linkage, Harrison (1980) opines that since the Benue River is a more powerful stream, a major capture is imminent which would deprive Chad of about 40% of its water supply. Harrison (1980) described Benue River as being unobstructed by severe rapids and its course may possibly correspond to a major fault line. Harrison (1980) also stated that Benue has many characteristics of a mature river. It has flat banks, which are extensively flooded in rainy season and offer possibilities for sugar and rice cultivation. The valley has been a route way for people coming from the east and northeast. The Benue River may be navigated from Lokoja to Makurdi between June and November, between Makurdi and Yola from July to early October and between Yola and Garoua in Cameroon in August and September (Reid and Sydenham 1979). Ita (1993) stated that beyond Makurdi, the flood plain narrows down to less than 5 km for a distance of over 100km and then expands from Ibi to more than 5km width for a further 100km or more.

There are many tributaries that add up to the main stack of the River, they include; Gongola, Katsina-Ala Dep, Mola, Taraba, etc. Although Reid and Sydenham (1979) defined the lower Benue to include Numan and Yola in Adamawa state, Ita (1993) restricted the lower Benue to cover Taraba tributary around Wukari and Ibi. According to Karl *et al* (1977) the fresh water fish fauna of Africa is characterized by great diversity as well as richness and also by development of extra ordinary species and high endemism among the cichlid fishes. There are numerous archaic and generalized forms like the lungfishes (Lopidosirinidae), and the Bichirs (Polypteridae), and a variety of Isospondylous groups including the endemic mormyrids (mormyridae).

The checklist of the lower Benue river fishes recorded by Reid and Sydenham (1979) comprise 128 species, representing 64 genera, 29 families and 11 orders, Method of collection was from fishermen who used different types of gear. Ita (1993) recorded 134 species in 34 families in the Niger Benue. According to him, the dominant species in order of commercial importance include; *Tilapia zilli, Synodontis batensoda, Citharinus citherus, Labeo coubie, Alestes barimose, Auchnoglais occidentalis Chrysichtys furcatus, Hydrocynus lineatus, Bagrus bagrus, Schilbe mystus, Lates niloticus, Mormyrus rumen, Clarias anguilaris, Heterotis niloticus and Distichodus brevipinus*. Other species of commercially less importance (caught in non commercial quantity) include *Heterobranchus bidorsalis, Clarotes laticeps, Cynoglossus and Paramchana obscura*.

This work assessed the assemblage of fin fish species found in the lower Benue River defined here as that part of the river contained within Benue state of Nigeria with a view to; determine the fin fish assemblage of the lower Benue River. Observe the catch composition/seasonality of the species and to further assess some physico-chemical characteristics of the lower Benue River.

MATERIALS AND METHODS

Study Area

The Benue River originates mainly in the Adamawa mountains of Cameroun, some 500km beyond the Nigeria frontier, and flows Eastwards through a catchment area, 800km of Nigeria territory before joining the River Niger at Lokoja. The lower Benue although strongly flowing, has many features of a mature river. The extensive alluvial plain (uncommon in African Rivers) stretching for many kilometers along the river route is an example of mature river. The greater part of this plain is flooded during the rainy season and, according to Reid and Sydenham (1979), forms breeding ground for many fish species. At bank full, the area of the lower Benue is 129,000 ha, but when flooded, this rises 310,000 ha and there can be as much as 25m difference between high and low water table. As highlighted by Reid and Sydenham (1979) the highest water levels are in August September and the lowest are in March and April. An upper Benue-Lake Chad connection is formed in the flood season when the Mayo kebbi (Benue) tributary captures the Logone River, which other-wise flows northwards to lake Chad. The link ways are interrupted in the dry season (January May) when many tributaries of the lower Benue river are reduced to isolated pools or anatomizing channels which are not connected to the main river.

Five (5) sampling stations already established by the Federal Department of Fisheries (FDF) on the main course and its major tributary were used for the study. The stations are: (1) Gbajimba (2) River Katsina-ala (tributary), (3) Abinsi, (4) Wadata and (5) Owcto all in Benue state.

Fish Sampling

Sampling was carried out using an outboard engine canoe (Suzuki 15HP) manned by the researcher and two assistants. In each of the station, which extends for 1km and more there are landing sites where the fishers come out to sell their catches. The fishers were contacted and they accepted us to sample (observe) their catches. Caught specimens were counted and identified (Babatunde and Raji 1998). They also disclosed to us the kind of gear used. Sampling was random within the stations and specimens were collected from the fishers where necessary either by kind donations or they were bought, and preserved in40% formalin solution. Discussions with the fishers revealed that the common gear in use in the lower Benue River include; gill nets (set, drifting and drag), hook and line, cast net, lift net and other traps. Other traps of various kinds constructed with local skills were observed but catches from these traps were not recorded at the time of sampling.

Sampling was carried out between July and December 2006 and January and June, 2007 cutting across the dry and wet seasons. In November, the water recede in volume and most swamps and rich areas of the river are accessible by the fishers, also fish migration is high, as the water volume reduces, and some are held in the adjoining lakes. Many fishing gears become operational (effective) at reduced water volume so catch is always higher during this season following the flood recession (Reed *et al* 1967). Dry season sampling period was between November and April while wet season sampling was between May and October.

Since the species distribution on the lower Benue is yet to be known, the non-parametric statistical approach was adopted. Scores were used following Alfred-Ockiya (1996) as follows: 1 500 = rare; 501 1500 = common; 1501 2000 = abundant and over 2001 as dominant to evaluate species abundance. Fish catches based on fishing gear were noted. Simple descriptive statistics; mean and percentage were used to describe species composition.

Physical and Chemical Parameters

A water analysis kit, HACH products model 2065 was used to assess the water parameters at various stations for observation. The kit is designed to assess for 8 water parameters and these include; temperature, P^H, alkalinity ($CaCo_3$) ammonia (NH_3), Cabondioxide (Co_2), Chloride (Nacl), Water hardness, dissolved oxygen (Do) and turbidity.

Statistical Analysis

The data were subjected to Anova to determine differences in abundance between the seasons, and where differences existed they were separated with Duncan Multiple Range test at 0.05% probability means.

RESULTS

Fish Assemblage and Species Composition

A total of 48 fish species in 32 genera under 18 families were recorded from the five sample stations established on the lower Benue River. The family Bagridae had the highest number of species (7) forming (7, 15%) of the species recorded; Mormyridae, Characidae, and Mochokidae each had 5 species (10.63% respectively) Cyprinidae, Clariidae and Cichilidae had 4 species recorded in each, forming 8.51% respectively. Citharinidae (3 species, 6.38%) and Schilbedae (2 species, 4.25%). The other 9 families had only 1 species (2.12%) each. Polyteridae was observed only in station 1. *patopterus annectens*, the single species in the only genera belonging to the family Lopidosirinidae was absent in station 2. Cichilidae showed abundance in all the stations sampled (See Table 1).

Seasonal Variation in species abundance

A total of 66,748 specimens (68%) were caught in the wet season being higher, but were of average sizes as many juveniles were abundant during the period. The catch recorded during dry season of 31,411, specimens was relatively low (32%) but was characterized by bigger size fishes and most of the female species were gravid at this time and were caught with eggs. Fishers confirmed and complained of low catches due to rising water levels at the peak of rainy season (August October) but catches improved during the receding water levels in November.

The mean seasonal variation in species abundance with significantly higher catches ($p \leq 0.05$) in the wet than dry season are shown in Table 2. However, there was no significant mean seasonal variation in abundance with station (Table 3).

Table 2. Mean seasonal variation in species Abundance in the Lower Benue River

Family	Dry	Wet
	Mean ± Sem	
ARIIDAE	11.200±42.722^{de}	28.200±66.566^{f}
BAGRIDAE	170.154±17.037^{bc}	287.558±26.545^{c-e}
CENTROPOMIDAE	85.800±42.722^{c-e}	142.000±66.566^{d-f}
CHARACIDAE	123.000±19.500^{a-c}	171.100±30.383^{d-f}
CICHLIDAE	292.767±22.517^{a}	485.100±35.083^{a}
CITHARINIDAE	80.800±24.666^{c-e}	131.600±38.432
CLARIIDAE	154.833±24.666^{ab}	254.600±38.432^{a-c}
CYPRINIDAE	21.050±21.361^{de}	35.000±33.283^{f}
GYMNARCHIDAE	95.200±42.722^{b-e}	152.400±66.566^{d-f}
HEPSETIDAE	140.400±42.722^{bc}	276.800±66.566^{b-d}
LEPIDOSIRINIDAE	19.800±42.722^{de}	43.800±66.566^{f}
MALAPTERURIDAE	62.800±42.722^{c-e}	104.000±66.566^{ef}
MOCHODIDAE	259.160±19.106^{a}	424.360±29.769^{ab}
MORMYRIDAE	83.700±20.139^{c-e}	139.267±31.380^{d-f}
NOTOPTERIDAE	16.400±42.722^{de}	4.000±66.566^{f}
OSTEOGLOSIDAE	43.200±42.722^{c-e}	78.400±66.566^{ef}
POLYPTERIDAE	4.200± 2.722^{a}	10.200±66.566^{f}
SHILBEIDAE	20.300±30.209^{de}	35.000±47.069

Means within a column with similar alphabets are not significantly different ($p<0.05$)

Table 3. Mean seasonal variation in species abundance with station in the Lower Benue River

STATION	SEASON	
	DRY	WET
	Mean ± S.E	Mean ± S. E
1	145 ± 134.39^{a}	236.958 ± 210.97^{a}
2	115 ± 115.20^{ab}	188.39 ± 193.25^{ab}
3	130 ± 113.31^{ab}	216.81 ± 189.11^{ab}
4	103 ± 103.41^{b}	169.10 ± 173.18^{b}
5	148 ± 123.98^{a}	239.70 ± 2.699^{a}

Means within a column with similar supercripts are not significantly different ($p<0.05$)

Physical and Chemical Characteristics

The results of the physico-chemical characteristics studied are as shown in Table 4.

Table 4: Some physical and chemical characteristics of the lower Benue River.

PARAMETERS	MEAN	MINIMA	MAXIMA
Temperature °C	24	18	33
PH	7.09	6.5	9.4
Alkalinity ($Caco_3$)mg/1	37.9	21	51
Ammonia (NH_3) mg/1	6.43	5.14	9.0
$C0_2$ (mg/1)	9.5	5	10
Chloride (Na C1) mg/1	12.8	04	20
Total Hardness (mg/1)	11	6.00	17
Dissolved Oxygen (mg/1)	11	8	16
Turbidity (Cm)	45	22	71

DISCUSSION

Generally, the distribution of fish species in the lower Benue River appear to be even on the main course, variations in abundance at some stations may be due to the vast breeding grounds offered by the swamps (fadama) like in Katsina-ala, Gbajimba and Abinsi (stations 1,2 and 3).

Reed *et al* (1967) recorded 31 families in the fisheries of Northern Nigeria. Ita (1993) recorded 33 families in the Niger Benue. Ried and Sydenham (1979) recorded 29 families with 128 species in the lower Benue. However, in this study only 48 species in 18 families were recorded. It will be noted that the 31 families recorded by Reed *et al* (1967) was a representation of the entire Northern Nigeria covering 5 River basins as delianated by Ita (1993, (Sokoto River basin, Kaduna River basin, Hadejia River basin, Gongola River basin and Taraba River basin).
The 128 species recorded in 29 families by Reid and Sydenham (1979) were from Benue River basin, down stream of the Faro-Benue confluence, an area, which is contained within the Federal Republic of Nigeria.

This research was limited to the lower Benue, defined as the area contained within Benue State of Nigeria. Species of fish recorded in nine families by Reid and Sydenham (1979), (Dasyatidae, Clupeidae, Pantodontidae Ichthyboridae, Cynolossidae and Tetraodontidae) were not found through out the study area. This may be due to the usual problems of collecting representative samples because all methods of catching fish are to some extent selective of species or size, and not all fishing methods were employed for this study. Hynes (1972) highlights that the difficulty is bad enough in lakes but worse in rivers and streams for various reasons, which may include large local differences between swift and slow reaches, or riffles and pools may tend to segregate species and size groups. Also, many species migrate along the rivers at different stages of their life histories. Thus the situation is rarely static, and it is difficult, if not impossible to discover in detail the population structure of many species.
Hynes (1972) observed that chemical content of running waters vary of course enormously from region and is a reflection of the local geography and climate. It is not however possible to work out the ratios of the various materials in solution from knowledge of mineral structure of the drainage basin: this is because of the differential solubility of minerals and the fact that the biota of the water exerts selective effects on many dissolved substances.
Clausen (1958) and Scheel (1975) both agree that substrate is of significance in the distribution of fish species. They compared the cyprinodont fish faunas of both Northern (including the lower Benue river basin) and Southern Nigeria. Hynes (1972) stated that in most rivers and streams, the turbulent mixing ensures a uniform distribution of dissolved substances but temporary temperature discontinuities may occur in pools and deep places. This condition is obtainable in the Lower Benue River as water parameters recorded at different stations showed uniform distribution at various seasons.

At present, agricultural and other developmental activities like land clearing, cultivation of crops (rice and sugar cane) could tend to increase erosion and give way for debris deposition in the fadama areas and river mouths (silting). These may result to reduced depths (aging out) of the river and its tributaries, this is likely to reduce breeding-grounds and affect fish recruitment. Of recent, there has been increased usage of herbicides

and pesticides by farmers. Abowei and Sikoki (2005) reported that insecticides, particularly the chlorinated hydrocarbons are the most common pollutants, and are characterized by having long residual lives and low water solubility. Water parameters recorded were only for observation so correlation to measure factors for species distribution was not done, they were however observed to show no significant variation among stations along the river course. Although the water parameters obtained for now and as recorded by Boyd (1979). are at optimum levels and indicate no polluted condition, results from agricultural and other developmental activities man have adverse effects on the biota of the Lower Benue River.
The research may not be detailed enough but results from the study as provided by the fishers, suggested a depletion of fish stocks as the efforts, time and financial resource per catch output was higher. The water parameters recorded are at optimum levels for fish abundance as they are similar to those recorded by Boyd (1979) hence depletion in the fish stock may by due to over fishing (disappearance of species of commercial target is due to pressure from fishers). Another factor that may explain the reduction in fish stock is aging out (reduced depths due to silting), chiefly from agricultural activities and urban development. Most of the swamps are now farmed and it affects fish breeding grounds.

For now, a polluted condition is not observed in the river, the growing rate of usage of Agricultural chemicals (herbicides, pesticides insecticides) is of concern to the fisheries managers. It is suggested that environmental assessment should be carried out in consultation with fisheries biologist (which is not so at present) in the 5 river basins earlier mentioned. There is great need to encourage and fund aquaculture projects in order to reduce the pressure of fishers on the fishery.

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